Gold Nanorods: The Most Versatile Plasmonic Nanoparticles.

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Abstract

Gold nanorods (NRs), pseudo-one-dimensional rod-shaped nanoparticles (NPs), have become one of the burgeoning materials in the recent years due to their anisotropic shape and adjustable plasmonic properties. With the continuous improvement in synthetic methods, a variety of materials have been attached around Au NRs to achieve unexpected or improved plasmonic properties and explore state-of-the-art technologies. In this review, we comprehensively summarize the latest progress on Au NRs, the most versatile anisotropic plasmonic NPs. We present a representative overview of the advances in the synthetic strategies and outline an extensive catalogue of Au-NR-based heterostructures with tailored architectures and special functionalities. The bottom-up assembly of Au NRs into preprogrammed metastructures is then discussed, as well as the design principles. We also provide a systematic elucidation of the different plasmonic properties associated with the Au-NR-based structures, followed by a discussion of the promising applications of Au NRs in various fields. We finally discuss the future research directions and challenges of Au NRs.